

REMARKS

By the foregoing Amendment, Claims 16-27 and 38 have been canceled, and Claims 28, 30, 32, 33, 35, 36 and 43 have been amended. Favorable reconsideration of the application is respectfully requested.

Claims 16-25, 27-43, and 45-46 were rejected as being obvious from Offill, in view of Rosemund et al. and Muller et al. Claims 16-25 and 27 are now canceled, and Claims 28 and 36 have been amended. Claim 28 has been amended to recite "a sheet of high tensile strength rigid polyvinyl chloride material having a flexural modulus of approximately 350,000 to 650,000," and Claim 36 has similarly been amended to recite "impregnating a face of a sheet of high tensile strength rigid polyvinyl chloride material having a flexural modulus of approximately 350,000 to 650,000 with a reactive resin that chemically bonds with a curing agent." Offill discloses a flexible liner forming a mechanical lock rather than bonding with a carrier material, as is discussed at column 7, lines 13-20, "so that the flexible liner can remain flexible with respect to and independent from the adjacent wall surface." The use of the flexible liner requires the use of a collapsible, traveling form 42, with a piston 47 and arms 48 and 50 to support the flexible liner while the carrier material is injected over it. It is respectfully submitted that Offill

does not teach or disclose the use of a sheet of high tensile strength rigid polyvinyl chloride material having a flexural modulus of approximately 350,000 to 650,000, and no motivation is provided in Offill for the use of such a sheet of high tensile strength rigid polyvinyl chloride material. Support for the limitation of the flexural modulus of approximately 350,000 to 650,000 can be found in the specification at page 14, lines 9-10, and support for the rigid nature of the sheet of polyvinyl chloride material can be found at page 8, lines 7-9, and page 12, lines 21-23. Further objective support for the rigid nature of the sheet polyvinyl chloride material is shown in the attached excerpt from Modern Plastics Encyclopedia 1984-1985, pages 480 and 481, in which polyvinyl chloride with a flexural modulus of 300,000 to 500,000 is categorized as being "rigid." It is respectfully submitted that Rosemund et al. and Muller et al. also do not teach, disclose, suggest or provide motivation for the use of a sheet of high tensile strength rigid polyvinyl chloride material having a flexural modulus of approximately 350,000 to 650,000, either separately or in combination with Offill.

Claims 26 and 44 were also rejected as being obvious from Offill, in view of Rosemund et al., Muller et al. , and Ranney et al. Claim 26 has been canceled, and it is respectfully submitted that Ranney et al., either separately or in combination with the other references, also does not teach teach, disclose, suggest or provide motivation for the

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use of a sheet of high tensile strength rigid polyvinyl chloride material having a flexural modulus of approximately 350,000 to 650,000 as is claimed.

It is respectfully submitted that the structural reinforcement provided by the sheet of rigid polyvinyl chloride material provides unexpected benefits of allowing the liner to be not only self-supporting but also to support the thermosetting material during installation, and to support the completed structure in a manner not suggested or taught in the references cited. It is therefore respectfully submitted that the rejections of the claims on the grounds of obviousness should be withdrawn in view of the claims as now amended.

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In light of the foregoing, it is respectfully submitted that the application should now be in a condition for allowance, and an early favorable action in this regard is respectfully requested.

Respectfully submitted,

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DGP/rvw

Encls.: Return Postcard

Excerpt, Modern Plastics Encyclopedia 1984-1985, pages 480 and 481 ✓
Version With Markings To Show Changes Made
Request for Three-Month Extension

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

28. (Twice amended) A load bearing structure having a closed-loop configuration in cross-section defining a predetermined interior, comprising an integrated, chemically continuous composite material having a plurality of regions continuing progressively from an outside of said structure to said interior of said structure, said composite material comprising:

a. a first compositional region comprising a porous, mineral-containing substrate having pores;

b. a second compositional region comprising a thermoset material chemically bonded by silane to, and intermixed with at least some of the mineral and within said pores of said substrate to form a matrix;

c. a third compositional region proximate and interphased with said second compositional region consisting of a thermoset material selected from the group consisting of polyurethane, epoxy and combinations thereof, and including silane;

d. a fourth compositional region proximate said third compositional region

15 and consisting of polyvinyl chloride having a substantial amount of hydroxyl ions
molecularly bonded to some isocyanates; and

e. a sheet of high tensile strength rigid polyvinyl chloride [thermoplastic]
material having a flexural modulus of approximately 350,000 to 650,000 proximate to
and defining said predetermined interior having a predetermined boundary and a
20 predetermined interior dimensions, said high tensile strength rigid polyvinyl chloride
[thermoplastic] material sheet having a tensile strength of at least 2200 pounds per square
inch, wherein said high tensile strength rigid polyvinyl chloride [thermoplastic] material
and thermoset material are bonded together and to said substrate with sufficient shear
strength to transmit and distribute loads on said substrate to said high tensile strength
25 rigid polyvinyl chloride [thermoplastic] material to improve the structural load bearing
strength of said load bearing structure.

30. (Amended) The load bearing [integrated composite] structure of
Claim 28 in which the rigid polyvinyl chloride material has [thermoplastic material sheet
is polyvinyl chloride having] a tensile strength in the range of from 5,000 psi to 10,000
psi.

32. (Amended) The load bearing structure of Claim 28 wherein said first face of said rigid polyvinyl chloride [thermoplastic] material sheet has a surface area, and wherein said integrated composite material further comprises means positioned on said first face of said rigid polyvinyl chloride [thermoplastic] material sheet for increasing the surface area of said first face.

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33. (Amended) The load bearing structure of Claim 32 wherein said means for increasing said surface area of said first face comprises ridges raised from said first face, comprising surface areas generally perpendicular to said rigid polyvinyl chloride [thermoplastic] material sheet.

35. (Amended) The load bearing structure of Claim 33 [34] wherein said raised ridges are positioned circumferentially in relation to said conduit.

36. (Twice amended) A method for lining a conduit having a porous substrate surface, the method comprising the steps of:

impregnating a face of a sheet of high tensile strength rigid polyvinyl chloride [semi-rigid thermoplastic] material having a flexural modulus of approximately

- 5 350,000 to 650,000 with a reactive resin that chemically bonds with a curing agent;
 positioning said sheet of high tensile strength rigid polyvinyl chloride
[semi-rigid thermoplastic] material within the interior of said conduit spaced apart from
said substrate surface to create a space between said rigid polyvinyl chloride [semi-rigid
thermoplastic] material sheet and said substrate surface;
- 10 inserting a mixture of a thermosetting material and said curing agent within
said space; and
 allowing said thermosetting material to bond with said substrate surface,
and allowing said face of said rigid polyvinyl chloride [thermoplastic] material to
chemically bond with said curing agent of said thermosetting material, wherein said rigid
15 polyvinyl chloride [thermoplastic] material and thermosetting material are bonded
together and to said substrate surface with sufficient shear strength to transmit and
distribute loads on said substrate surface to said high tensile strength rigid polyvinyl
chloride [semi-rigid thermoplastic] material to reinforce said conduit.

43. (Amended) The method of Claim 36, further comprising the step of
forming raised ridges on said face of said rigid polyvinyl chloride [thermoplastic]
material to increase the surface area of said face.

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| Materials | Properties | ASTM test method | Block copolymers of styrene and ethylene or butylene | Thermoplastic elastomer (Cont'd) | | | | | | |
|--|--|--|--|----------------------------------|------------------|---------------------------------|---|---|---|---|
| | | | | Polyurethane | | | | | | |
| | | | | Solution coating resins | | Molding and extrusion compounds | | | | |
| | | | | Polyester | Polyether | Polyester | | Polyether | | |
| Low and medium hardness | High hardness | Low and medium hardness | High hardness | | | | | | | |
| Processing | 1. Melting temperature, °C. T _m (crystalline) T _g (amorphous) | | | -20 to +16 | -49 | 120-160 | 120-160 | 120-160 | 120-160 | |
| | 2. Processing temperature range, °F. (C = compression; T = transfer; I = injection; E = extrusion) | | C: 300-380 T: 350-480 E: 330-380 | | | I: 380-435 E: 370-410 | I: 410-440 E: 370-410 | I: 350-430 E: 340-410 | I: 400-435 E: 380-440 | |
| | 3. Molding pressure range, 10 ³ p.s.i. | | 1.5-20 | | | 0.8-1.4 | 0.8-1.4 | 0.6-1.2 | 1-1.4 | |
| | 4. Compression ratio | | 2.5-5.0 | | | | | | | |
| | 5. Mold (linear) shrinkage, in./in. | D955 | 0.006-0.022 | | | 0.008-0.015 | 0.005-0.015 | 0.008-0.015 | 0.008-0.012 | |
| Mechanical | 6. Tensile strength at break, p.s.i. | D638 ^b | 1000-3000 | 4500-7900 | 5500 | 3300-8400 | 4000-11,000 | 1500-6750 | 6000-7240 | |
| | 7. Elongation at break, % | D638 ^b | 600-850 | 290-630 | 530 | 410-620 | 110-550 | 475-1000 | 340-425 | |
| | 8. Tensile yield strength, p.s.i. | D638 ^b | | | | | | | | |
| | 9. Compressive strength (rupture or yield), p.s.i. | D695 | | | | | | | | |
| | 10. Flexural strength (rupture or yield), p.s.i. | D790 | | | | | | | | |
| | 11. Tensile modulus, 10 ³ p.s.i. | D638 ^b | | 0.33-1.45 ^c | 0.7 ^c | | | | | |
| | 12. Compressive modulus, 10 ³ p.s.i. | D695 | | | | | | | | |
| | 13. Flexural modulus, 10 ³ p.s.i. | 73° F. D790 200° F. D790 250° F. D790 300° F. D790 | 4-100 | | | | | | | |
| | 14. Izod impact, ft.-lb./in. of notch (1/4-in. thick specimen) | D256A | No break | | | | | | | |
| | 15. Hardness | Rockwell D785 Shore/Barcol D2240/ D2583 | Shore A50-90 | Shore A70-D54 | | Shore A55-95 | Shore D46-78 | Shore A70-92 | Shore D55-75 | |
| | Thermal | 16. Coef. of linear thermal expansion, 10 ⁻⁶ in./in./°C. | D696 | | | | | | | |
| 17. Deflection temperature under flexural load, °F. | | 264 p.s.i. D648 66 p.s.i. D648 | | | | | | | | |
| 18. Thermal conductivity, 10 ⁻⁴ cal.-cm./ sec.-cm. ² °C. | | C177 | | | | | | | | |
| Physical | 19. Specific gravity | D792 | 0.9-1.2 | 1.19-1.22 | 1.11 | 1.17-1.25 | 1.15-1.28 | 1.10-1.20 | 1.14-1.21 | |
| | 20. Water absorption (1/4-in. thick specimen), % | 24 hr. D570 Saturation D570 | 0.17-0.42 | | | | 0.3 | | | |
| | 21. Dielectric strength (1/4-in. thick specimen), short time, v./mil | D149 | | | | | | 470 | 470 | |
| Design and performance properties For more detailed information on performance and design properties of plastics, by trade name and grade, see the following charts: Chemical resistance p. 482 Dimensional stability p. 565 Electromagnetic shielding p. 556 Environmental stress-crack resistance p. 578 Fatigue p. 586 Optical properties p. 591 In the 1983-1984 edition of MPE, see: Creep p. 512 Dielectric loss properties p. 533 Films p. 502 Foams p. 507 Impact resistance p. 564 Laminates, by NEMA grades p. 510 Outdoor exposure resistance p. 579 Poisson's ratio p. 592 In the 1981-1982 edition of MPE, see: Flammability p. 564 Pipe p. 552 In the 1980-1981 edition of MPE, see: Specifications/materials p. 597 Temperature Index p. 632 | | | SUPPLIERS^a | Concept Polymer; Dow Chem. | Goodrich | Goodrich | Upjohn; Dainippon; Goodrich; Mobay; Ohio Rubber | Upjohn; Goodrich; Mobay; Ohio Rubber | Upjohn; Goodrich; Mobay; Ohio Rubber | Upjohn; Goodrich; Mobay; Ohio Rubber |

^a—Boldface listings identify advertisers in this issue. Where advertisements relate to the particular materials described, reference to the page number is included. See the Directory of Suppliers Classified Index, page 708, for additional suppliers of specialty materials and custom compounds.

^b—Tensile test method varies with material; D638 is standard for thermoplastics; D638 for rigid thermosetting plastics; D412 for elastomeric plastics; D882 for thin sheeting.
^c—Secant modulus at 100% elongation.

Urea

Vinyl polymers and copolymers

| | | | Polyvinyl chloride and polyvinyl chloride-acetate molding compounds, sheets, rods, and tubes | | | Molding and extrusion compounds | | | |
|--|--|---|---|---|--|---------------------------------|--|--------------------------|--------------------------|
| | | | Rigid | Flexible, unfilled | Flexible, filled | Vinyl formal | Chlorinated polyvinyl chloride | Vinyl butyral, flexible | PVC/acrylic blends |
| 1. | Thermoset | | | | | | | | |
| 120-160 | | 75-105 | 75-105 | 75-105 | 75-105 | 105 | 110 | 49 | |
| I: 400-435 E: 380-440 | C: 275-350 I: 290-320 T: 270-300 | I: 270-405 | C: 285-400 I: 300-415 | C: 285-350 I: 320-385 | C: 285-350 I: 320-385 | C: 300-350 I: 300-400 | C: 350-400 I: 395-440 E: 360-415 | C: 280-320 I: 250-340 | I: 360-390 E: 390-410 |
| 1-1.4 | 2-20 | 8-25 | 10-40 | 8-25 | 1-2 | 10-30 | 15-40 | 0.5-3 | 2-3 |
| | 2.2-3.0 | 1.6-2.2 | 2.0-2.3 | 2.0-2.3 | 2.0-2.3 | | 1.5-2.5 | | 2-2.5 |
| 0.008-0.012 | 0.006-0.014 | 0.001 | 0.002-0.006 | 0.010-0.050 | 0.008-0.035 0.002-0.008(trans.) | 0.001-0.003 | 0.003-0.007 | | 0.003 |
| 6000-7240 | 5500-13,000 | 9500 | 5900-7500 | 1500-3500 | 1000-3500 | 10,000-12,000 | 6800-9000 | 500-3000 | 6400-7000 |
| 340-425 | <1 | 2-3 | 40-80 | 200-450 | 200-400 | 5-20 | 4-65 | 150-450 | 35-100 |
| | | | 5900-6500 | | | | 6000-8000 | | |
| | 25,000-45,000 | 9000 | 8000-13,000 | 900-1700 | 1000-1800 | | 9000-22,000 | | 6800-8500 |
| | 10,000-18,000 | 13,500 | 10,000-16,000 | | | 17,000-18,000 | 14,500-17,000 | | 10,300-11,000 |
| | 1000-1500 | 870 | 350-600 | | | 350-600 | 341-475 | | 340-370 |
| | | | | | | | 335-600 | | |
| | 1300-1600 | 750 | 300-500 | | | | 380-450 | | 350-380 |
| | | | | | | | | | |
| | 0.25-0.40 | 1.0 | 0.4-22 | Varies over wide range | Varies over wide range | 0.8-1.4 | 1.0-5.6 | Varies over wide range | 1-12 |
| 0-92 Shore D55-75 | M110-120 | R118 | | | | M85 | R117-122 | A10-100 | R106-110 |
| | | | Shore D65-85 | Shore A50-100 | Shore A50-100 | | | | |
| | 22-36 | | 50-100 | 70-250 | | 64 | 68-78 | | 68-79 |
| | 260-290 | 155 | 140-170 | | | 150-170 | 202-234 | | 167-185 |
| | | 165 | 135-180 | | | | 215-247 | | 172-189 |
| | 7-10 | | 3.5-5.0 | 3-4 | 3-4 | 3.7 | 3.3 | | |
| 0 1.14-1.21 | 1.47-1.52 | 1.54 | 1.30-1.58 | 1.16-1.35 | 1.3-1.7 | 1.2-1.4 | 1.49-1.58 | 1.05 | 1.26-1.35 |
| | 0.4-0.8 | 0.01 | 0.04-0.4 | 0.15-0.75 | 0.5-1.0 | 0.5-3.0 | 0.02-0.15 | 1.0-2.0 | 0.09-0.18 |
| | | | | | | | | | |
| 470 | 300-400 | 600-800 | 350-500 | 300-400 | 250-300 | 490 | | 350 | 480 |
| Am. Cyanamid; Budd; MKB; Petent Plastics; Perstorp | LNP; Thermofil | Alpha Chem. (see ad, p. 95); Occidental; Union Carbide; Air Products; Borden; Colorite; Conoco; Georgia-Pec.; Goodrich; Goodyear; Keysor-Century; Novatec; Pentasote; Steuffer; Tenneco | Alpha Chem. (see ad, p. 95); Occidental; Schutman (see ad, p. 103); Union Carbide; Air Products; Borden; Colorite; Conoco; Georgia-Pec.; Goodrich; Keysor-Century; Pentasote; Tenneco | Alpha Chem. (see ad, p. 95); Occidental; Schutman (see ad, p. 103); Union Carbide; Air Products; Borden; Colorite; Conoco; Georgia-Pec.; Goodrich; Keysor-Century; Pentasote; Tenneco | Alpha Chem. (see ad, p. 95); Occidental; Union Carbide; Air Products; Borden; Colorite; Conoco; Georgia-Pec.; Goodrich; Keysor-Century; Pentasote; Steuffer; Tenneco | Monsanto | Goodrich | Union Carbide; Monsanto | Sumitomo (see ad, p. 91) |

or thermoplastics; D651
s: D882 for thin plastic